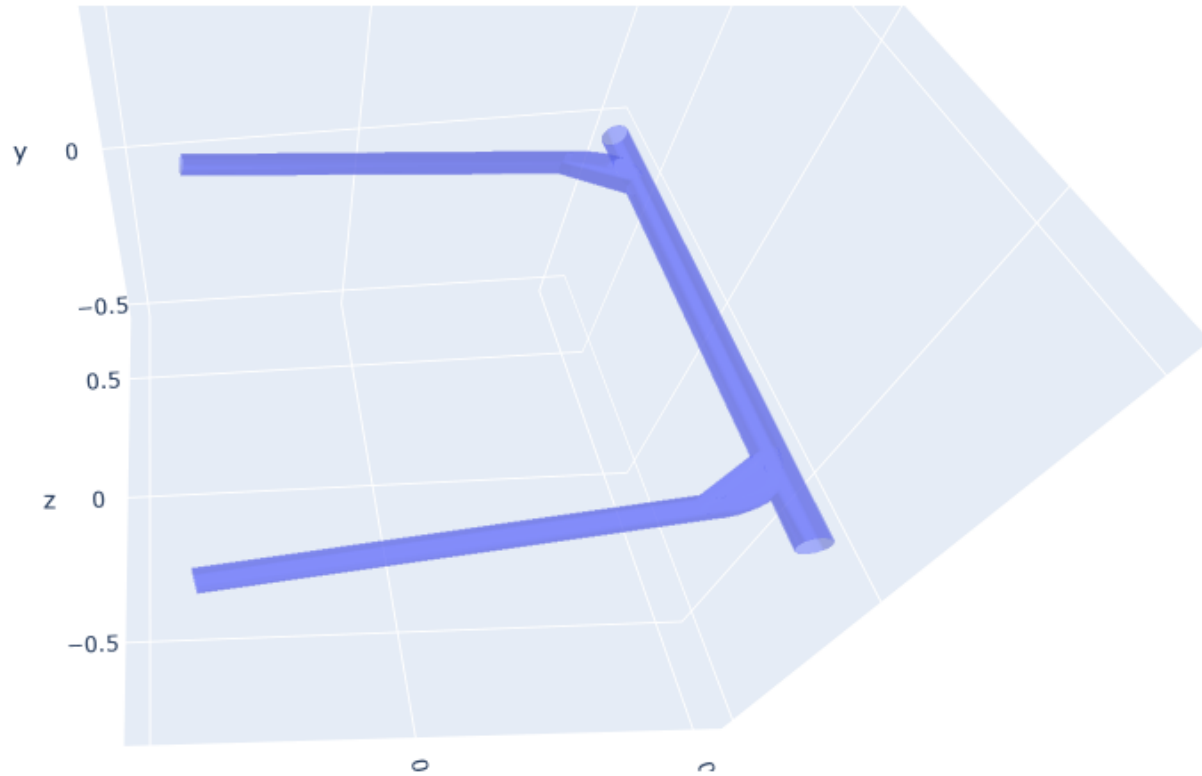


Warp Beam Dynamics Simulation Update

Chris Hall

2-23-2021

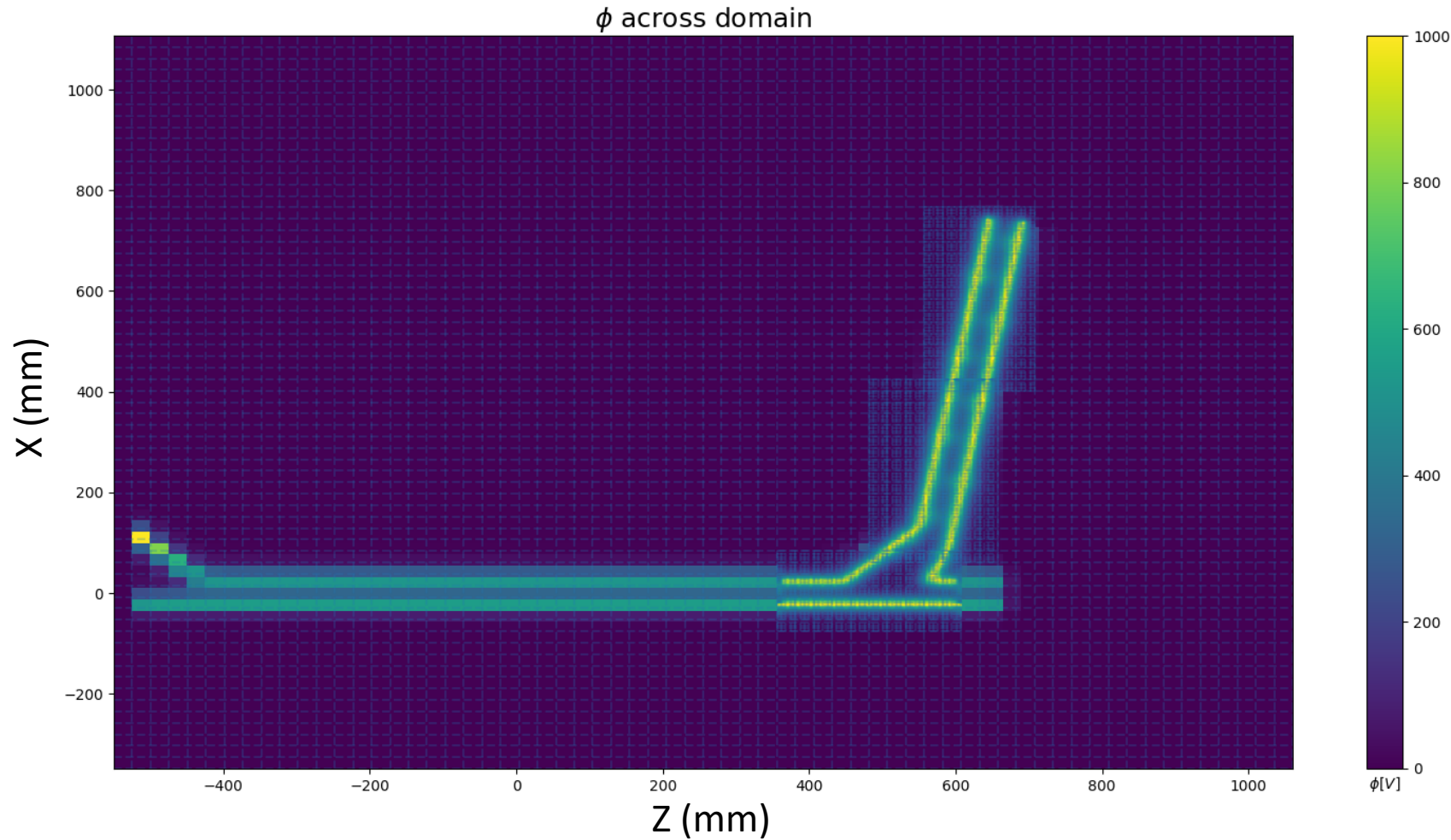
Adding pipe boundary



Imported from STL file into Warp

- Processing intercepts with mesh to get boundary potential
- Only works with Warp's fast scraper – no intercept information is calculated

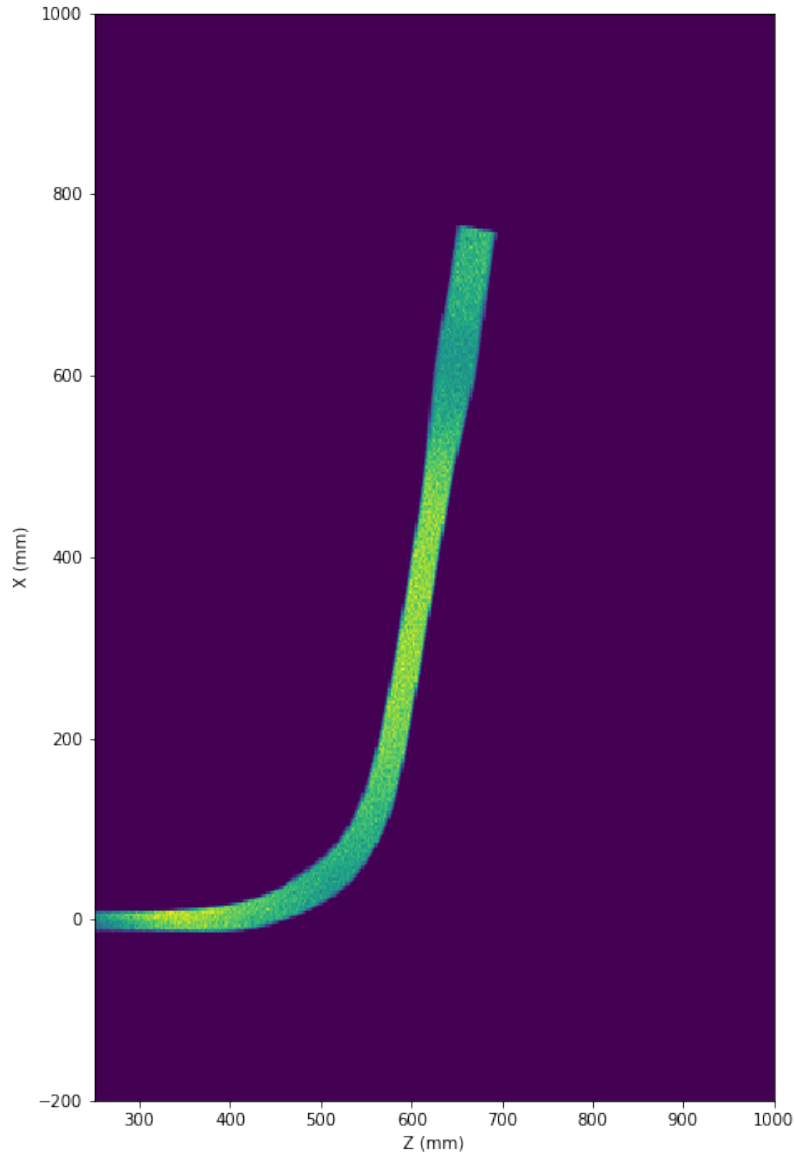
Registering with Field Solver



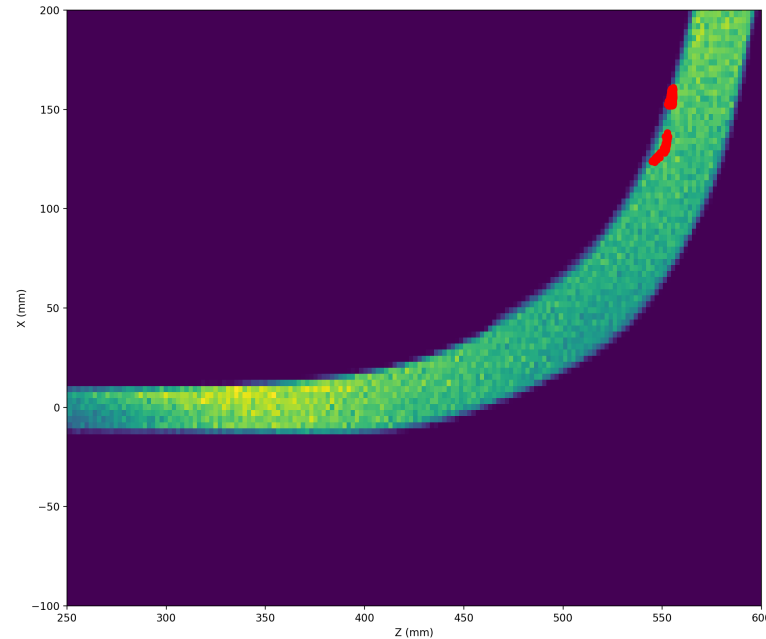
Verify registration with field solver by setting non-zero potential on the pipe

Updated STL conductor import to work with Warp mesh refinement solver

Testing with Scraper



Sample scraped particle locations



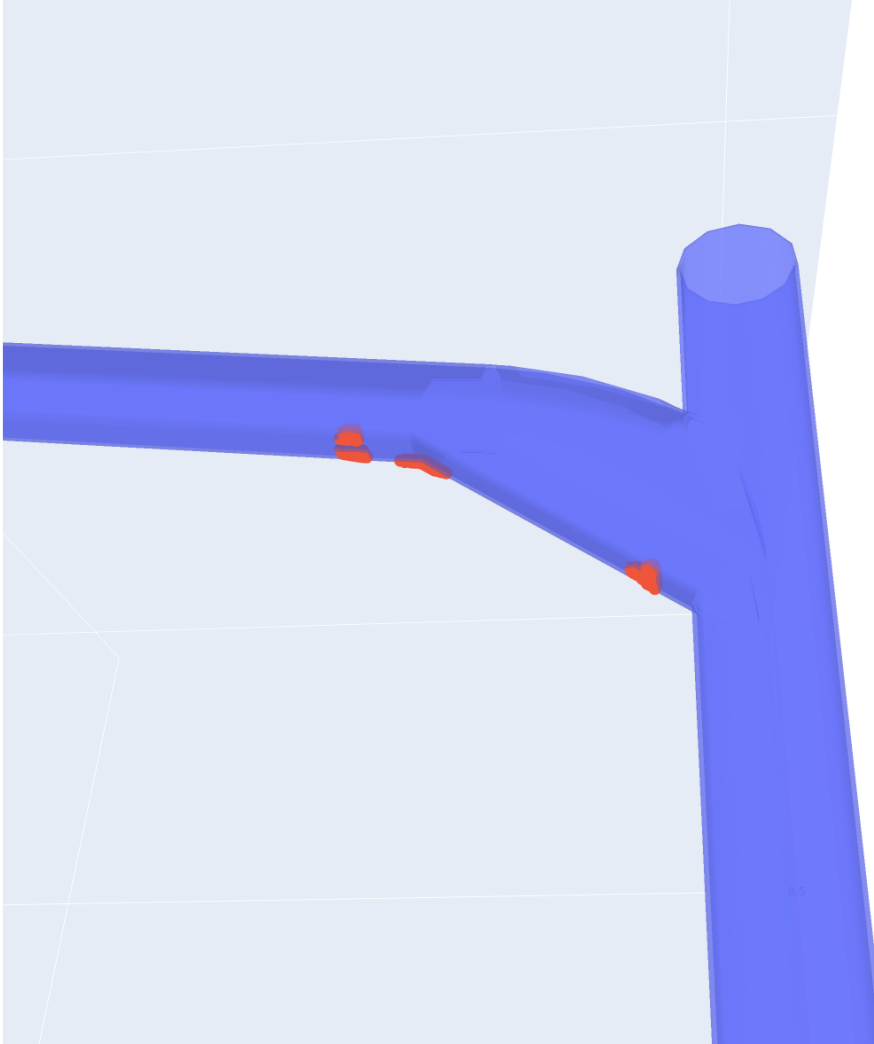
Beam parameters:

- Uniform Transverse distribution
 - Radius: 22 mm
- Current: 10 mA
- KE: 8 keV

Scraping is observed, but only with large radius

Testing with Scraper

Sample scraped particle locations

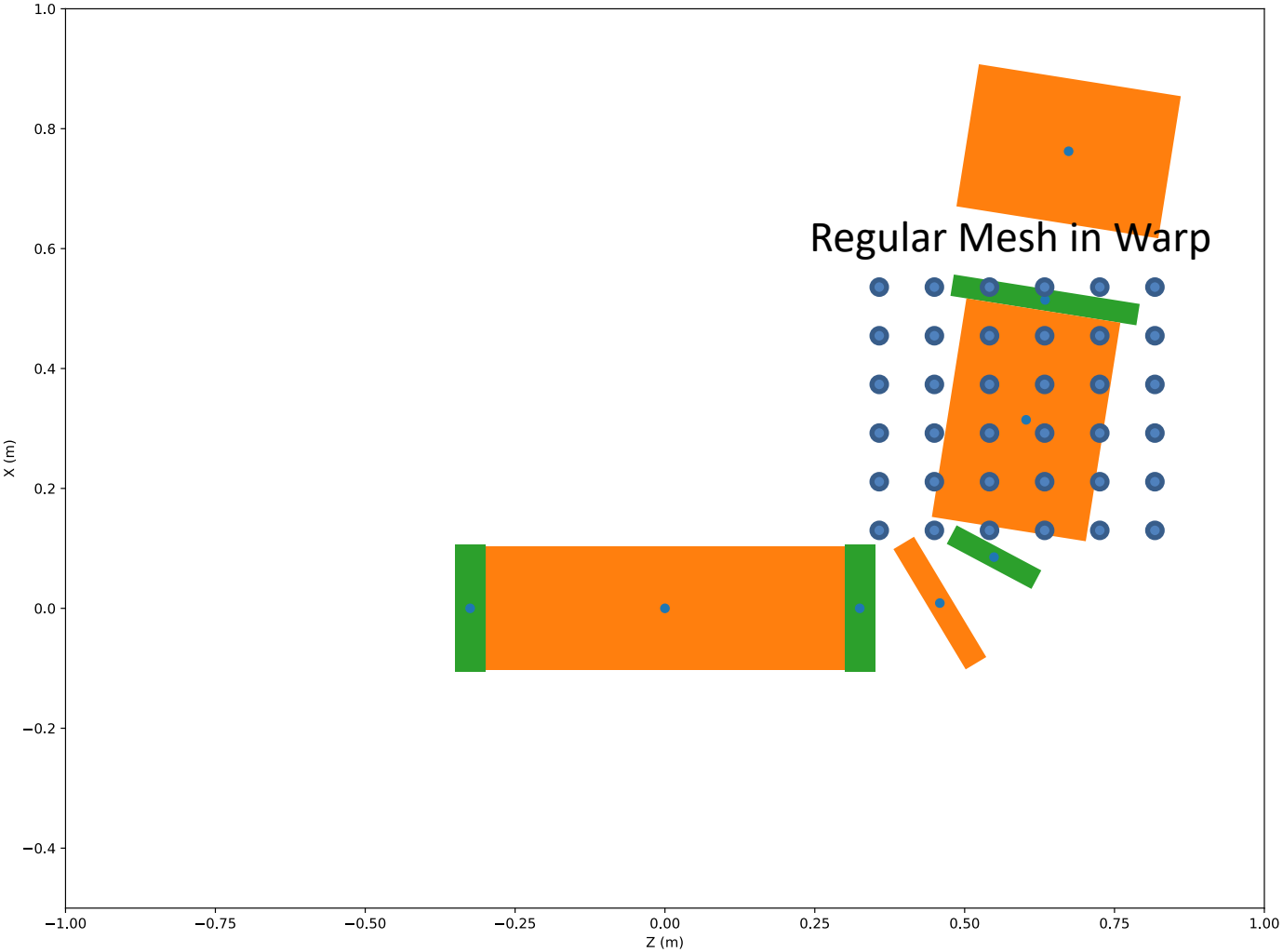
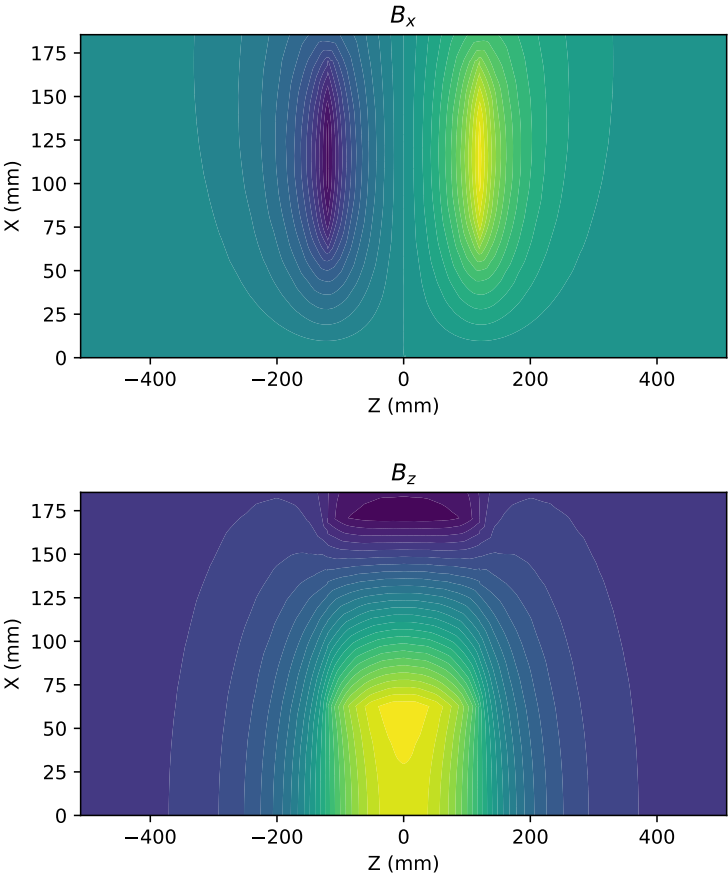


Beam parameters:

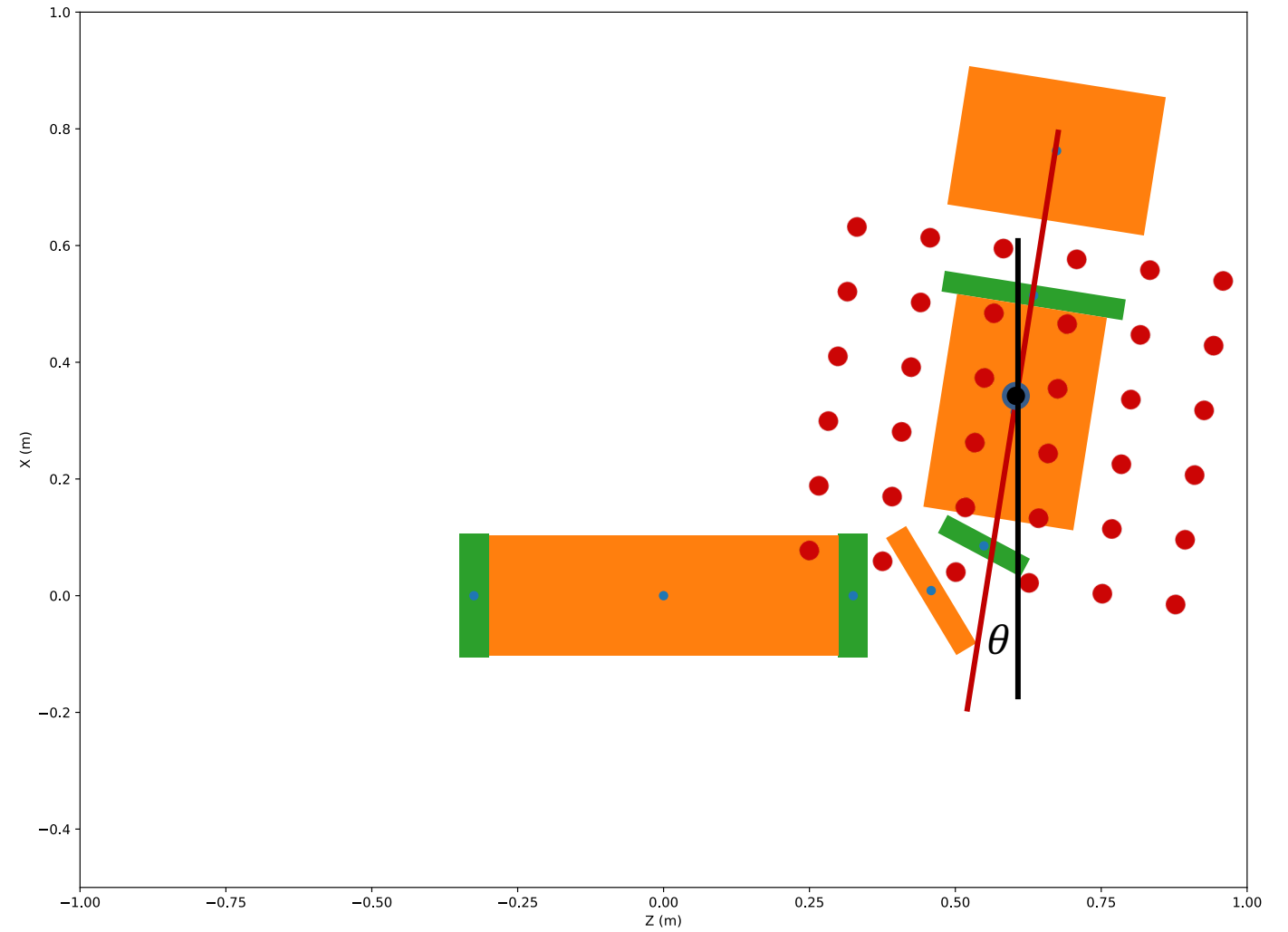
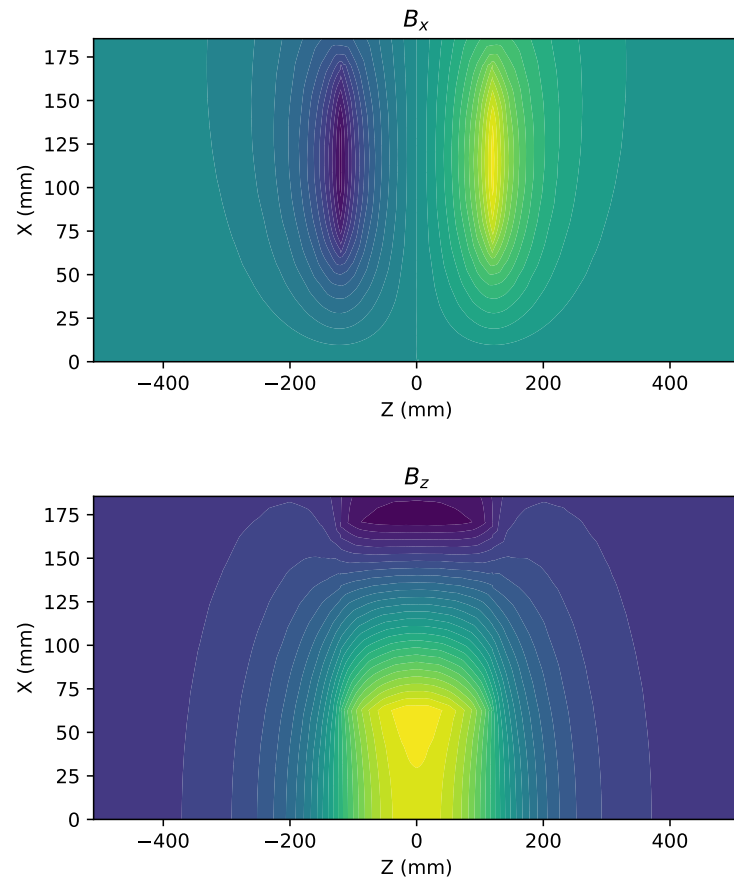
- Uniform Transverse distribution
 - Radius: 22 mm
- Current: 10 mA
- KE: 8 keV

Field Map Import

CST Field Map



Field Map Import

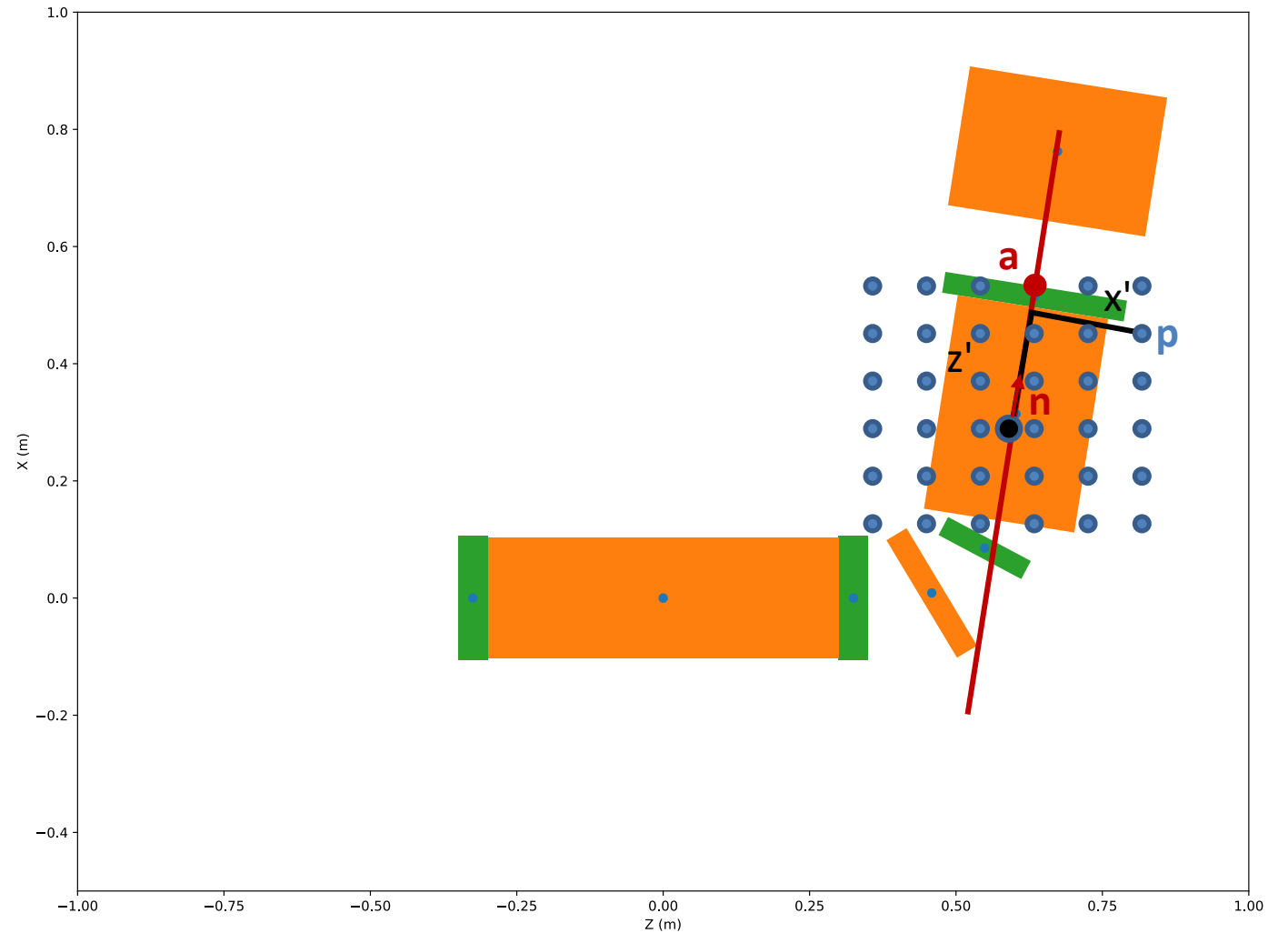


Field Map Import

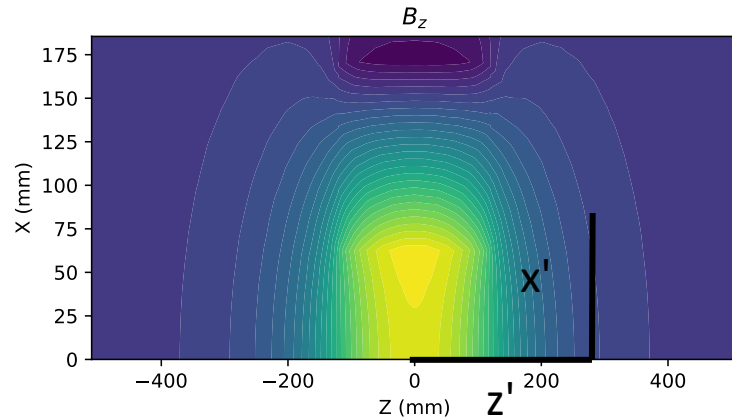
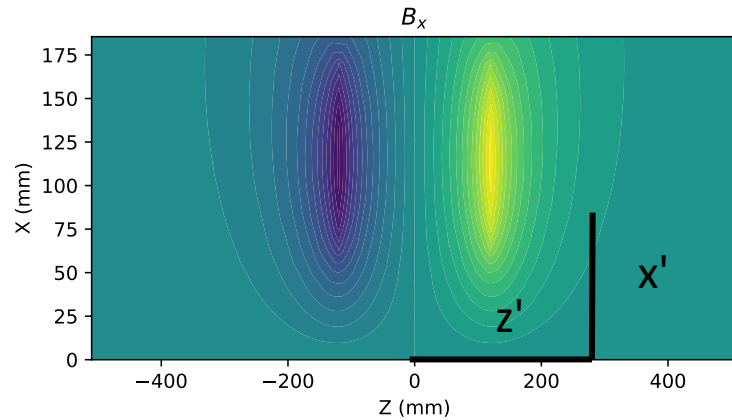
$$x' = \|(\mathbf{a} - \mathbf{p}) - ((\mathbf{a} - \mathbf{p}) \cdot \mathbf{n})\mathbf{n}\|$$

$$z' = \|(\mathbf{a} - \mathbf{p}) - ((\mathbf{a} - \mathbf{p}) \cdot \mathbf{n})\mathbf{n} + \mathbf{p}\|$$

$$\phi = \arctan\left(\frac{y}{x'}\right)$$



Field Map Import



1. 2D Interpolation of CST field map for B_x and B_z (Uses SciPy RegularGridInterpolator)
2. Extract field value at (z', x')

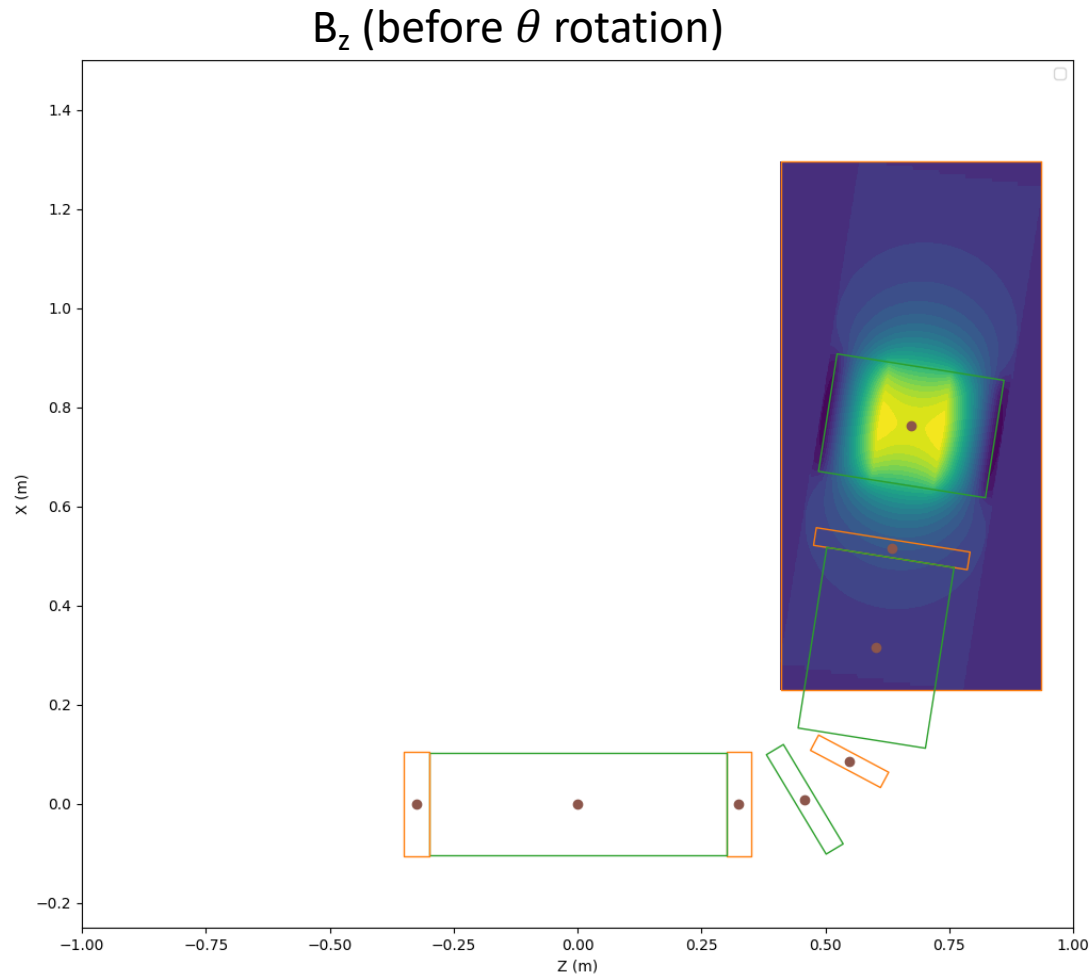
$$B'_x = B_x \cos(\phi)$$

$$B'_y = B_x \sin(\phi)$$

$$B'_z = B_z$$

3. Rotate \mathbf{B}' by θ to get \mathbf{B} on the Warp grid

Field Map Import



1. 2D Interpolation of CST field map for B_x and B_z (Uses SciPy RegularGridInterpolator)
2. Extract field value at (z', x')

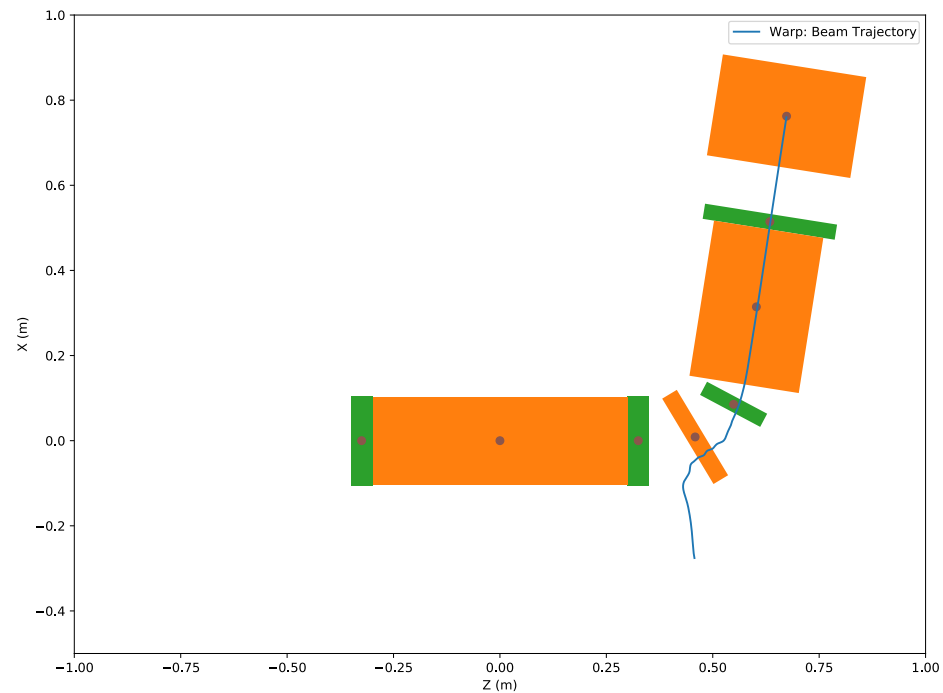
$$B'_x = B_x \cos(\phi)$$

$$B'_y = B_x \sin(\phi)$$

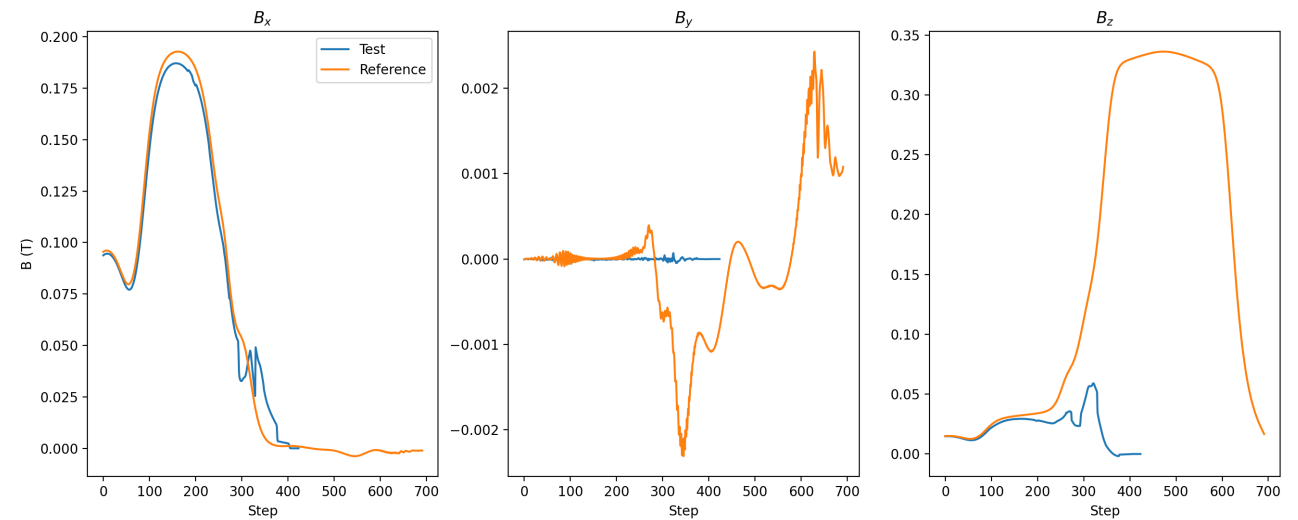
$$B'_z = B_z$$

3. Rotate \mathbf{B}' by θ to get \mathbf{B} on the Warp grid

Field Map Import



Reference taken from simulation in Warp using single, large field map through main solenoid



Implementation still has error(s)